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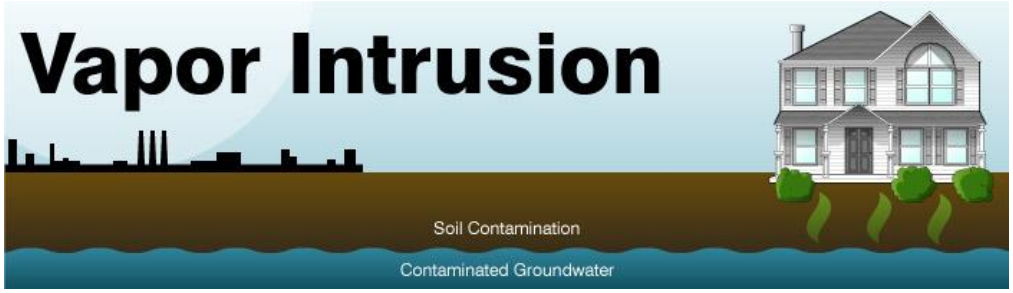
Vapor Intrusion Assessments
Introduction to Collecting Quality Vapor Samples

- Regulatory overview
- Sampling methodologies
- Equipment
- The laboratory



Tom Yoder
Product Manager

John Reynolds
Customer Service Manager

April 21, 2016

The migration of volatile chemicals from the subsurface into overlying buildings.

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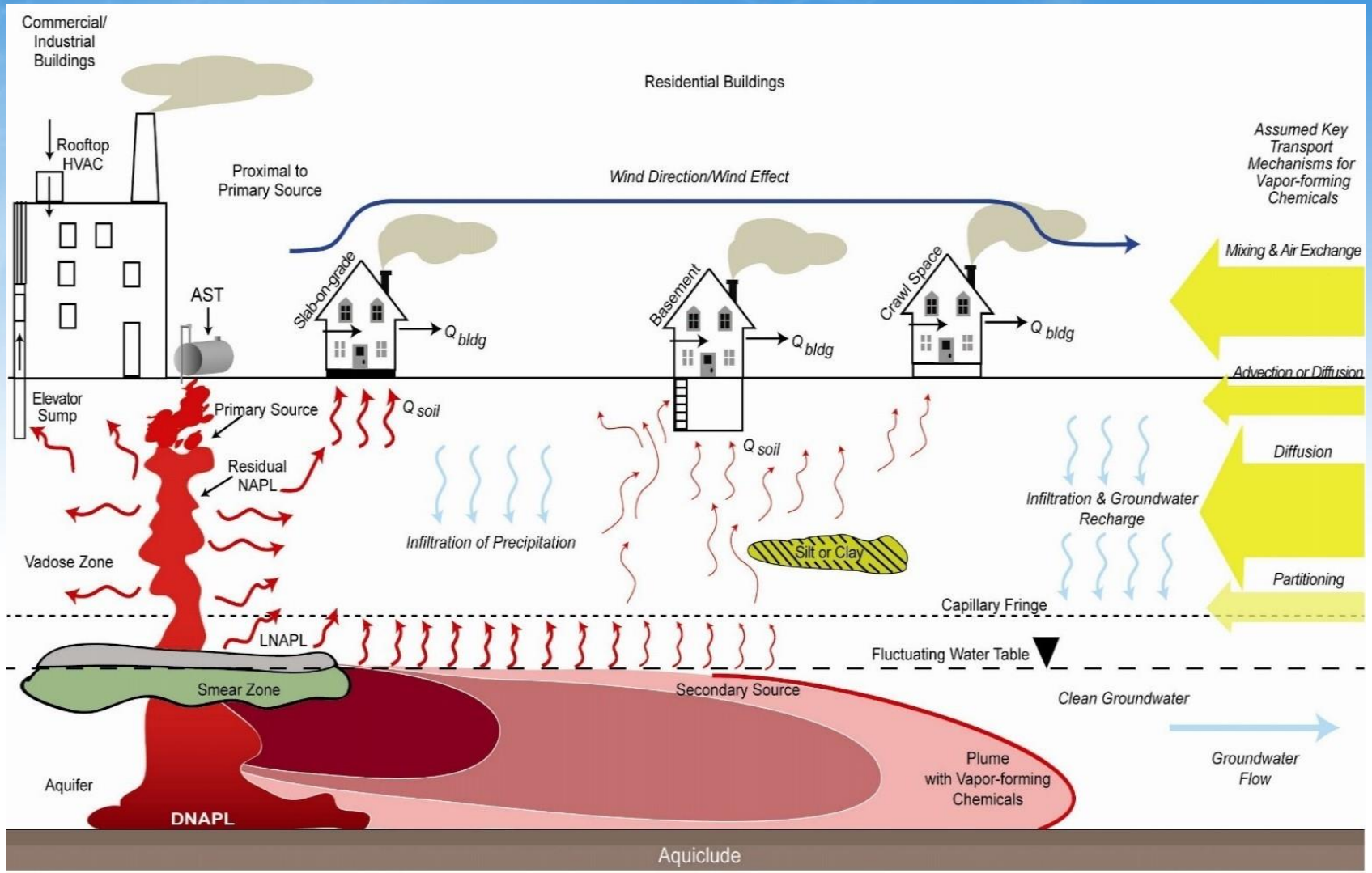

http://www.epa.gov/oswer/vaporintrusion/

Vapor Intrusion Timeline

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EPA OSWER finalizes Vapor Intrusion Guidance **2015**

EPA OUST and ITRC work to publish Petroleum Vapor Intrusion Guidance **2014**

OSWER revises and works to finalize 2002 Draft Vapor Intrusion Guidance **2013**

ASTM D7663-11 "Standard Practice for Active Soil Gas Sampling in the Vadose Zone for VI..." **2011**

ASTM E2600-10 "Standard Guide for Vapor Encroachment Screening in Real Estate…" **2010**

ITRC Publishes Vapor Intrusion Guidance **2007**

NY Publishes Guidance, Re-opens 1400 NFR Sites **2006**

OSWER replaces 2001 RCRA Guidance **2002**

Redfield Rifle Site and CDOT Site **1998**

J&E model published **1991**

New in 2016!
Superfund
On February 29, the USEPA **proposed** to add a subsurface intrusion score to the Hazard Ranking System for NPL sites.

1976 **1990** **1995** **2000** **2005** **2008** **2012** **2014** **2015**

1976 - 1986
Core environmental regulations enacted
RCRA, TSCA, CERCLA, HSWA, SARA

1995 - 2000
States begin addressing Vapor Intrusion: MA, CT, CA

2001 - 2008
EPA OSWER Publishes Guidance in 2002
Some States Publish VI Guidance

2010 - 2014
Other States and organizations issue draft or final guidance.

2015
EPA's Final Guidance on VI and PVI is published.

Modified from: M. Traister, O'Brien & Gere

Final EPA VI Guidance

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FINALLY

OSWER Publication 9200.2-154

OSWER TECHNICAL GUIDE FOR ASSESSING AND MITIGATING THE VAPOR INTRUSION PATHWAY FROM SUBSURFACE VAPOR SOURCES TO INDOOR AIR

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response

June 2015

OUST Publication EPA 510-R-15-001

Technical Guide For Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites

U.S. Environmental Protection Agency
Office of Underground Storage Tanks

June 2015

http://www.epa.gov/oswer/vaporintrusion/

EPA Proposed Rule

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Federal Register - 40 CFR Part 300 - Addition of a Subsurface Intrusion Component to the Hazard Ranking System; Proposed Rule

EPA–HQ–SFUND–2010–1086; FRL–9925–69–OLEM

- On Feb. 29, 2016, the EPA proposed to add a subsurface intrusion (SsI) component to the Hazard Ranking System
  - used to evaluate sites for placement on the National Priorities List (NPL).
- Enables EPA to use remedial authority under CERCLA.
  - introduces a complex scoring system to quantify the threat of intrusion.
  - includes radionuclides.
- Does not affect the status of current sites or current proposed sites.

- Comments are due by April 29, 2016.
- Projected publish date of Dec. 2016

https://yosemite.epa.gov/opei/rulegate.nsf/byRIN/2050-AG67

Vapor Intrusion – Chemicals of Concern

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- The two most common classes of chemicals of concern are: **chlorinated solvents (CHCs) and petroleum hydrocarbons (PHCs)**.

- PHCs typically biodegrade in groundwater and in unsaturated soil zones. This aerobic biodegradation can limit the potential for petroleum vapor intrusion (PVI).
  - ~ In the presence of oxygen, PHCs biodegrade readily.

- In contrast, biodegradation of CHCs is anaerobic, which is generally slower. This limited biodegradability is to some degree responsible for the greater observed prevalence of chlorinated solvent vapor intrusion (CVI) as compared with PVI.

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TABLE 1-2
DIRECTORY TO ADDITIONAL UPDATES IN THIS TECHNICAL GUIDE PUBLICLY IDENTIFIED BY OSWER (EPA 2010B)

Topics to Be Updated, Including References to the Draft VI Guidance	Location Within This Technical Guide
Observational data since 2002 indicates that the "single line of evidence" approach with site-estimated attenuation factors is generally not appropriate for external soil gas samples.	Section 6.4.4 and Appendix A
Experiences since 2002 illustrate the value of collecting indoor air samples earlier in the investigations. The "indoor air last" approach has been updated, which will allow more flexibility in the sequencing of subsurface and interior/indoor sample collection.	Sections 6.3.4 and 6.3.6
The portions addressing background contamination have been updated. EPA also updated with more specific methodologies for evaluating and/or decision-making and managing background contamination.	Sections 6.3.5, 7.4 and 7.6
The portion of this Technical Guide focusing on testing indoor air has been updated to allow more flexibility in the duration of sampling to take advantage of other sampling durations and methods.	Section 6.4.1
The Draft VI Guidance allows site-specific decisions to be made based on indoor air concentrations in a relatively few representative buildings. This portion of this Technical Guide has been updated to increase the confidence that the approach fully addresses building-by-building variability.	Sections 6.2.2 and 7.8

Page 15, Table 1-2
Note important updates to Indoor Air Testing

http://www.epa.gov/oswer/vaporintrusion/

Key Recommendation Highlights

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Limit analyses to chemicals of concern

- Section 6.4

Assess the VI pathway using multiple lines of evidence

- Sections 6.3, 7.1 & 7.2

Generally support the decision to collect indoor air data

- Section 6.3.4 & 6.4.1

Consider collecting multiple rounds of indoor air samples

- Section 7.4

Document objectives and methods in a VI work plan

- Section 6.2

The Conceptual Site Model (CSM)

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"A CSM integrates all lines of site-specific evidence into a three dimensional conceptualization of site conditions…"

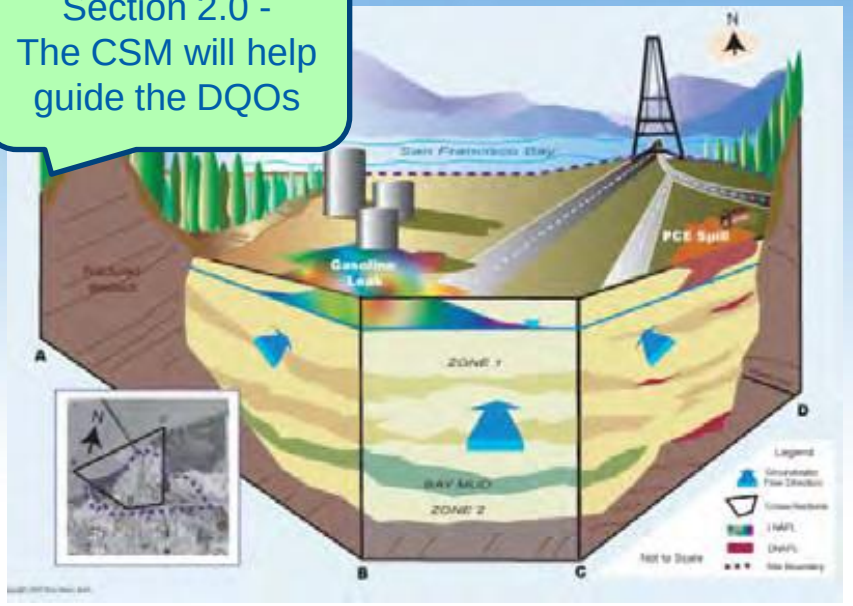
A picture and narrative of the site and it's contamination

- How it got there
- Is it migrating or degrading
- It's distribution across the site
- Who might be exposed and at what levels

Considerations:

- Site conditions and historical data
- Screening levels being applied
- Sampling protocols being used
- Compounds of concern
- Anticipated concentrations

Section 2.0 - The CSM will help guide the DQOs



Rick Ehrhart, RCRA Corrective Action, EPA Region 6, ehrhart.richard@epa.gov

Involve the lab early to ensure that data quality objectives can be met.

Sources of Variability

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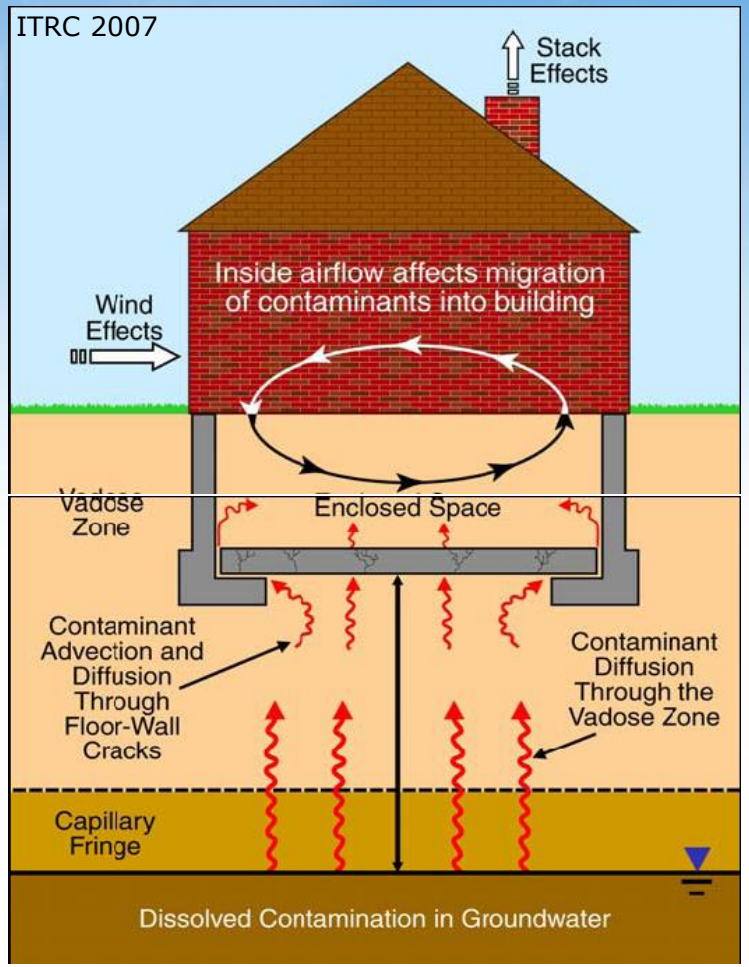
http://www.itrcweb.org/gd_VI.asp



Sources of Potential Variability in Measured Data

Barometric pressure

Surface cover

Preferential pathways

Soil moisture & permeability

Seasonal effects: Advection

Biodegradation

Background air

Multiple Lines of Evidence

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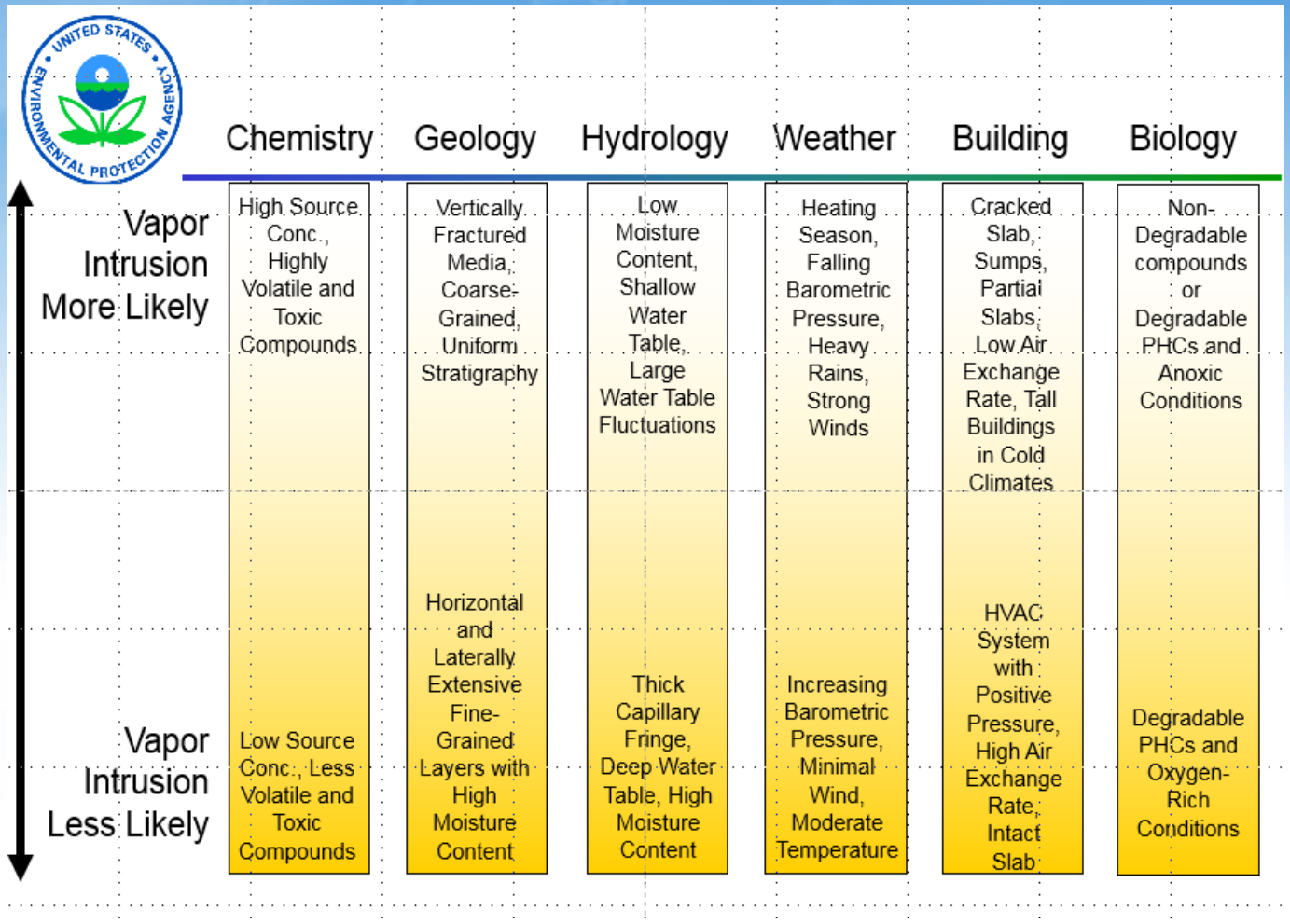

http://www.epa.gov/oswer/vaporintrusion/

Vapor Intrusion Concurrent Sampling

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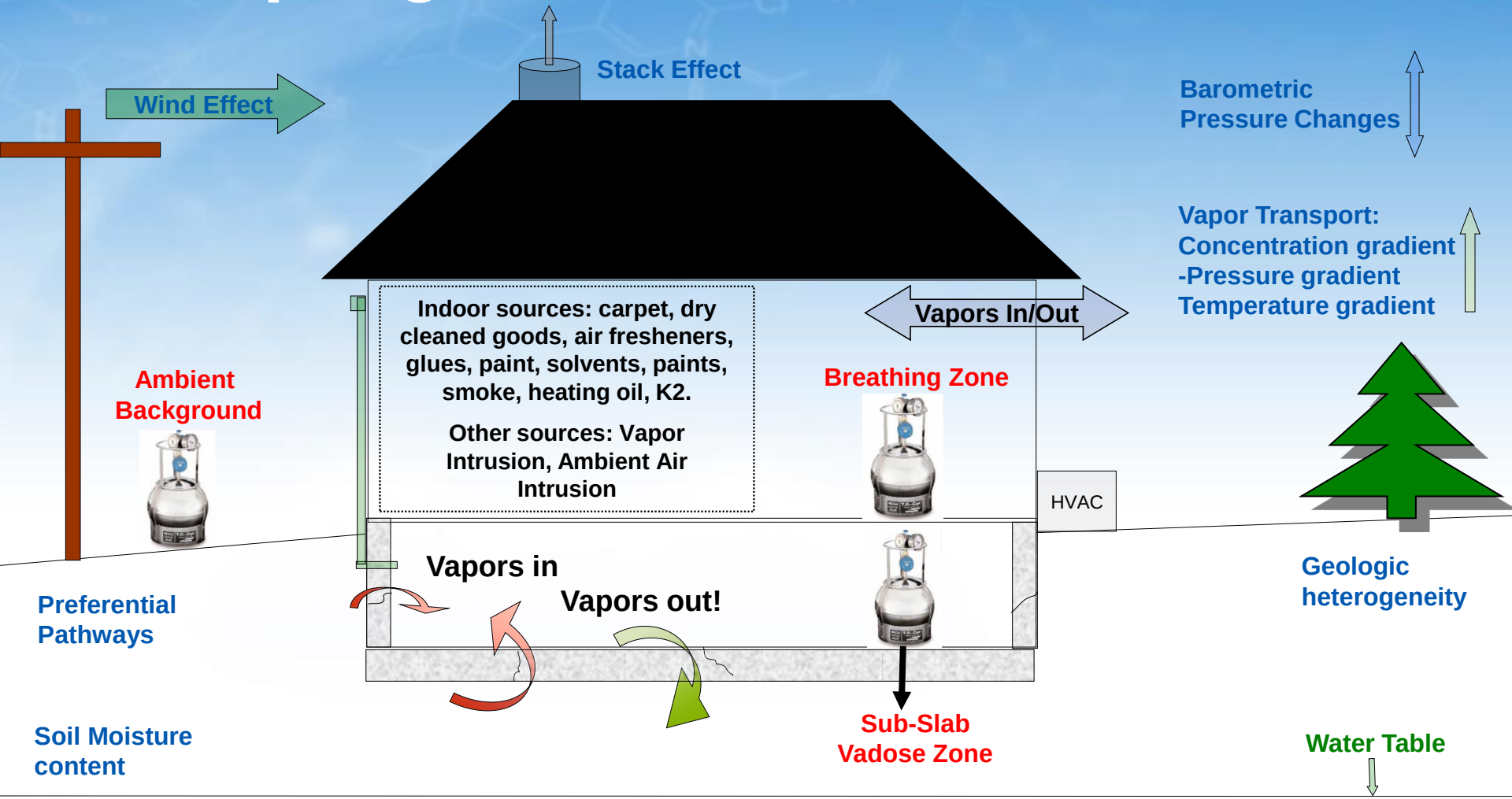

Indoor Air Sampling

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Pros

- Actual indoor air concentration, no modeling, no attenuation factors
- Relatively quick, no drilling or heavy equipment
- Less spatial variability than soil gas

Section 6.4.1 "A potential shortcoming of indoor air is background"

Cons

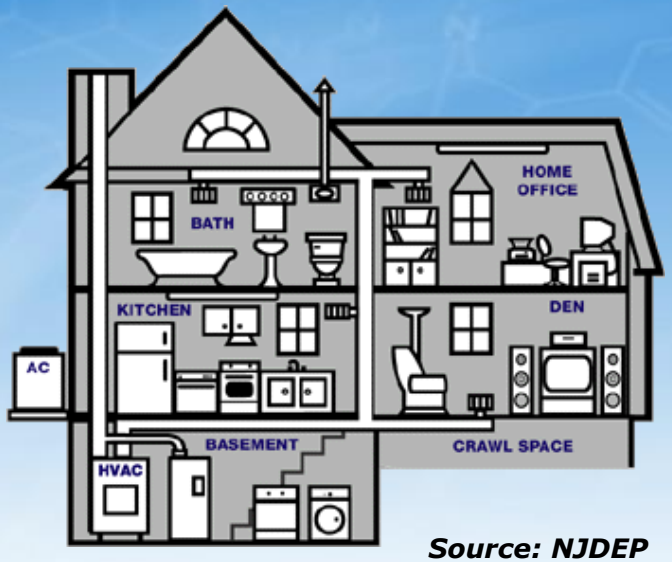
- Working with the "Homeowner" or "Building owner" requires time, effort and finesse
- Access agreements, factsheets, meetings
- Requires removal of potential interior or lifestyle sources
- ***Contribution from unknown indoor sources and ambient air***

Per EPA: Collect indoor samples and compare with controls

- Sub slab, ambient, lines of sight and building specific evidence

Modified from: Rick Ehrhart, RCRA Corrective Action, EPA Region 6

Background Contamination



Source: NJDEP

- Consumer Activities
- Household Products
- Building Materials
- Outdoor Air

Section 6.3.5 Identify & Evaluate Contributions from Indoor & Ambient Sources

Common Household Contaminants

Acetone	Formaldehyde
Benzene	n-Heptane
Bromomethane	n- Hexane
2-Butanone (MEK)	Methylene chloride
Chlorobenzene	Methyl isobutyl ketone
Chloroethane	Methyl tert butyl ether
Chloroform	Styrene
Cyclohexane	1,1,2,2-Tetrachloroethane
1,4-Dichlorobenzene	Tetrachloroethene (PCE)
Dichlorodifluoromethane	Toluene
1,1-Dichloroethane	1,1,1-Trichloroethane
1,3-Dichloropropene	Trichloroethene (TCE)
Ethylbenzene	Xylenes, total

http://www.state.nj.us/dep/srp/guidance/vaporintrusion/

Sub Slab Sampling

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Pros

- Can be used to resolve indoor sources vs. a VI source
- Can be used to assess if the VI migration route is complete
- Can be used to assess the potential for VI risk

Cons

- Method is intrusive
- Requires access agreement and entry into buildings.
- ***Substantial spatial variability under the slab***

Per EPA: Collect multiple samples per building to address spatial variability and multiple rounds to address temporal variability.

Section 6.4.3 "There may be substantial spatial variability in sub-slab soil gas"

“In Field” Leak Detection

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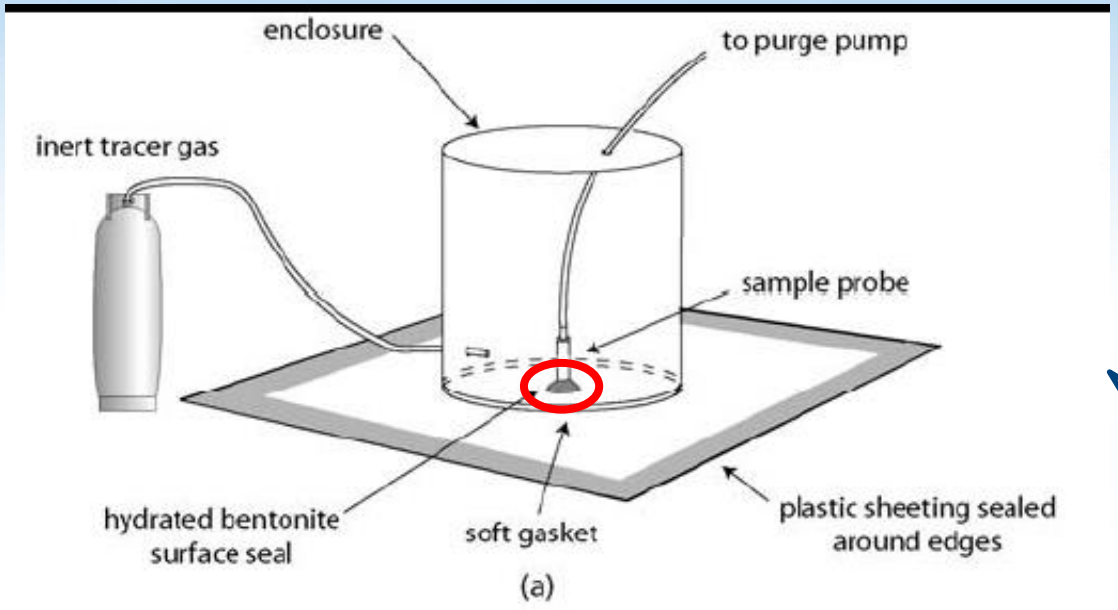
Leak check procedure /Tracer Gases:

- Use a portable monitoring device to analyze prior to sampling
- If high concentrations (> 10%) are observed, the probe seal should be enhanced to reduce the infiltration of ambient air



https://www.health.ny.gov/environmental/investigations/soil_gas/svi_guidance/docs/svi_main.pdf

Companies such as:

Ashtead Technology Rentals

http://www.ashtead-technology.com/us/

Section 6.4.4 “a reliable seal of the annulus between the probe and the probe housing and leak testing for the seal are generally recommended”

Soil Gas Sampling

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Pros

- Near source, it may provide an estimate of source vapor concentration
- Can be performed without entering the structure

Cons

- Significant lateral and vertical spatial variability
- May not be representative of vapor concentrations under buildings

Per EPA: “Several rounds of sampling are generally recommended, particularly…”

Section 6.4.4 “individual exterior soil gas samples cannot generally be expected to accurately estimate sub-slab or indoor air concentrations”

Modified from: Rick Ehrhart, RCRA Corrective Action, EPA Region 6

Field Quality Control Samples

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Field Duplicates

- Require the use of a “T-fitting” or “Co-locator”

Media Selection

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Determined by reporting limit requirements

Summa Canisters:

Soil Gas: 1L generally acceptable

Ambient & Indoor Air: 6L only

Flow Controllers

- Preset by the laboratory for 5 min- to 24hrs

Tedlar Bags:

- For gases and high levels of detection

Sampling Equipment

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6 liter canister with 200 ml flow meter

6 liter canister with 24hr flow controller

200 ml flow meter with filter and gauge – Soil gas sampling

Flow controller with filter and gauge – Indoor or ambient sampling

Media Certification and Management

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Canisters are segregated for cleaning
- Low level (ambient & indoor)
- Source level (soil gas)

Canister Cleaning
- Evacuated, heated, pressurized w/ zero air or nitrogen

Certification
- Batch or individual
- Leak free – overnight leak check test required

Flow Controller Certification: Cleaned & Performance checked

Tubing & Gauges, Impact to Data?

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Field Sampling Media

Tubing options:
Stainless steel < **Teflon FEP** < Polyethylene < **Nylaflow**

Tips:
Minimize length and store properly

Initial Vacuum – confirm sufficient vacuum is in the canister.

- Range will be 25-30”Hg

Final Vacuum – confirm sufficient sample was collected.

- Range should generally be 10-0”Hg

Shipping, Preservation and Holding Times

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Canisters

- No preservation required
- Can be shipped by air with a few caveats
- **Hold time specified in TO-15 is 30 days**

Section 6.4.1 "Fourteen days is the most commonly cited hold time for air samples in canisters"

Tedlar bags

- No preservation required
- Can be shipped by air with a few caveats
  - ~ Do not overfill
- Hold time is 72hrs

Involve Your Laboratory in the Planning Process

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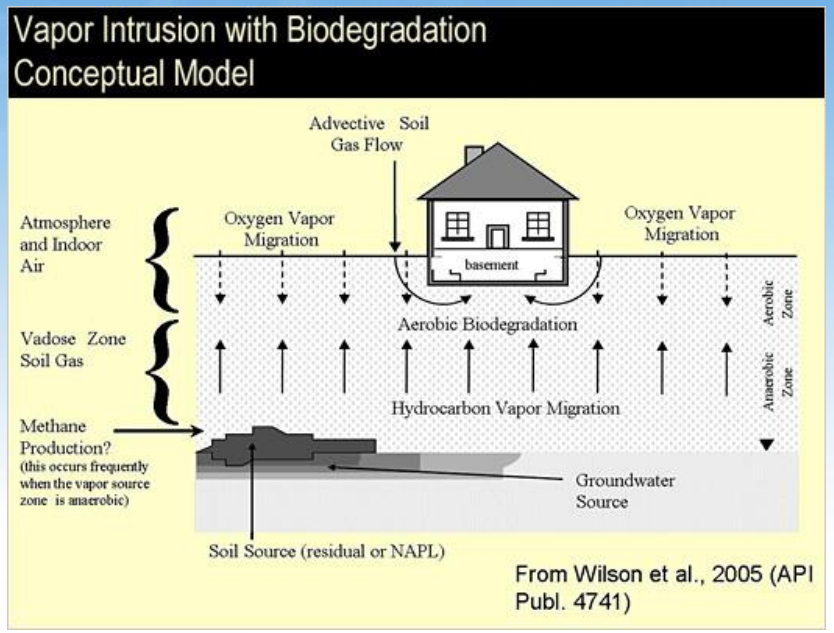
- Compounds of concern & anticipated concentrations
- Detection limits
- Type(s) of sampling equipment
  - 1 liter vs 6 liter
  - Batch vs Individual certification
  - Tubing
  - Flow controllers and settings
  - T-fitting
  - Extra fittings
- Number of samples
- Sample types
- Report type



Involve the lab early. Request comments on the conceptual site model (CSM) and achievability of data quality objectives

Summary

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Do not take samples unless you have some idea of what the data is going to tell you

- Conceptual Site Model

Define your data quality objectives up front, this will determine the appropriate containers, collection procedures and analyses

Over communicate with your testing laboratory. Teamwork up front will ensure less discussion when you receive your data

Data quality is a function of the whole process: the project set up, the field sampling protocols, and the analytical protocols

Thank You for Attending

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Questions?

Vapor Intrusion Contacts

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